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(54) **Telecommunication system, in particular telephone system.**

(57) The system comprises a plurality of intercoupled sub-systems (DS). Each sub-system (DS) comprises a control-unit (MCU) and at least one peripheral module (PM) to which communication lines can be connected. A problem involved is that when establishing a connection between two terminals (T) connected through the communication lines to the system a large number of data has frequently to be passed from and to the terminals.

The data management becomes more effective and more economic with the control-unit (MCU) of each sub-system (DS) comprises a list of numbers inside the system and that on the basis of a number of a desired destination connected to a communication line provided by a source connected to a communication line it is determined to which sub-system (DS) the destination is associated. When the destination sub-system is a system differing from the source sub-system, the required (signalling) information about the identity and characteristic of the source is transmitted to the control-unit (MCU) of the destination sub-system, whilst the connection is passed on to the destination sub-system. The control-unit of the destination sub-system then analyses said information and establishes the connection, as the case may be.

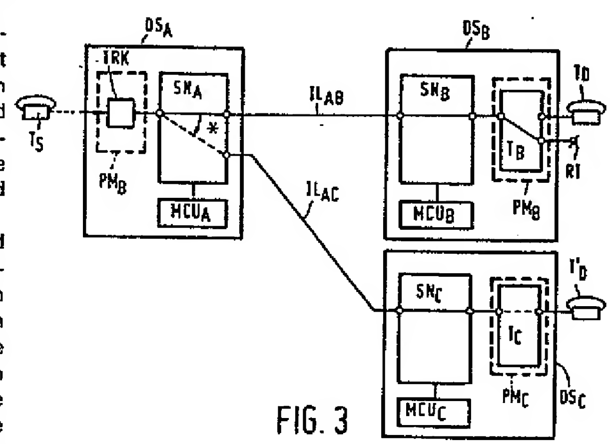

FIG. 3

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Telecommunication system, in particular telephone system.

The invention relates to a telecommunication system, in particular a telephone system comprising a plurality of intercoupled sub-systems, each sub-system comprising a switching system, a control-unit and at least one peripheral module, to which communication lines can be connected.

Such a telecommunication system is generally known. In a telecommunication network of sub-systems found in industrial telephone exchanges the network is normally composed of independent sub-systems, each of which manages the variable (and semi-variable) permanent data of its own connections. It is often unavoidable that each data system must also comprise "global net data" such as routining data or data concerning presence or absence of teleprinters. Then consistency problems may occur when the network has to be approached as a whole by operational maintenance in order to change the data.

A further problem is that in distributing interrelated data about the sub-systems the data management becomes particularly complicated, for example, by relation variations. It may then also occur that data relating to connections have to be taken from various places, which gives rise to delays and, moreover, brings about a higher input/output activity of the control-unit.

The invention has for its object to provide a telecommunication system of the kind set forth in the preamble by which an effective and economic data management is created in a simple manner. The telecommunication system is characterized in that the control-unit of each sub-system has a list of numbers inside the system, that on the basis of a destination number provided by a source connected to a peripheral module via a communication line,

it is determined to which sub-system the destination is associated, which destination is connected to a peripheral module *via* a communication line, and that when the destination sub-system differs from the source sub-system the necessary (signalling) information about identity and characteristics of the source is transmitted to the control-unit of the destination system and the connection is passed on to the destination sub-system and in that the control-unit of the destination sub-system analyses said information and, as the case may be, establishes the connection with the destination.

When the destination is diverted (for example in the case of a diversion for non-response) the destination sub-system transfers in accordance with the invention, the information about the new destination to the control-unit of the sub-system to which the new destination is associated through the control-unit of the source sub-system.

It is advantageous when the sub-systems are coupled with multiplex lines, which include at least one channel for transferring information.

It is furthermore advantageous for said channel to be a 64 k bit/s common channel signalling channel inside a 2 Mbit/s multiplex line.

Embodiments of the invention and their advantages will be set out with reference to the drawing, in which corresponding elements are designated by the same reference symbols. The drawing shows in

Fig. 1 a telecommunication system embodying the invention comprising three part systems,

Fig. 2 a block diagram of part of a telecommunication system for illustrating rousing a terminal in accordance with the invention,

Fig. 3 a block diagram of part of a telecommunication system for illustrating ringing when diverting a connection in accordance with the invention,

Fig. 4 a block diagram of part of a telecommunication system for illustrating the operator's

handlung of an outgoing connection in accordance with the invention and

Fig. 5 a block diagram of part of a telecommunication system for illustrating the operator's handling of an outgoing connection to a non-free terminal in accordance with the invention.

Fig. 1 shows a telecommunication system comprising three sub-systems DS_1, DS_2 and DS_3. The sub-systems are connected by intersystem-lines IL_{12}, IL_{23} and IL_{13}. Each sub-system comprises a switching network SN and one or more peripheral modules PM serving to connect subscriber lines SL to the switching network SN concerned. Furthermore each sub-system comprises a control unit MCU, which is also connected to the switching network SN. To the subscriber lines may be connected a telephone set, a terminal, a graphical display unit or a different end apparatus. In accordance with the magnitude of the system the switching system may comprise a single T stage or a TST (in general a TnST) network.

The establishment of a connection between two terminals connected to the system takes place as follows. If a terminal T_S, the source terminal being connected to sub-system DS, desires a connection to terminal T_D the destination terminal connected to sub-system DS_3, the desired connection of the source is announced - in a further conventional manner - through the peripheral module PM_1 to the switching network to the control-unit MCU of the sub-system DS_1. The characteristics and the identity of the source and the identity of the destination are investigated in the control-unit MCU_1. It is in particular assessed to which sub-system the destination is connected. For this purpose each control-unit has a list indicating which numbers are associated with which sub-system. If it is found that the destination is lying in a different sub-system - in this example the destination is lying in sub-system DS_3 - the control-unit MCU_1 of the first part system DS_1 transfers the required information about the identity and

characteristics of source and destination to the processing unit of the sub-system with which the destination is associated (MCU_3). The transfer of this information is performed through the intersystem lines interconnecting the subsystems, in this example the intersystem line IL_{13}. In addition the connection between the source and the destination sub-system is passed on, which means that a path is created from terminal T_S via peripheral modules PM_1, through switching network SN_1 and via intersystem line IL_{13} to the switching network SN_3 of sub-system S_3. In sub-system DS_3 a connection is then established between the destination T_D and the input concerned of the switching system SN_3. The establishment of this connection is in fact, for the sub-system SN_3 nothing else than the establishment of a connection between two parts (source and destination) connected, so to say, to the same sub-system, since the sub-system itself contains all information required for making the connection in its own sub-system and owing to the further switching of the source sub-system the source is, so to say, displaced to an input of the destination sub-system.

The intersystem lines may be multiplex lines having a transmission capacity of 2 M bit/s, subdivided into 32 channels of 64 k bit/s each. One (or more) of these channels is (are) reserved for the transmission of the (signalling) information.

Although Fig. 1 shows three sub-systems, the invention is not limited thereto: it may be fewer or more than three systems. It is also possible for the inter-system lines to be formed by a bundle of two or more parallel lines. Moreover, complete meshing is not strictly necessary.

The idea of the invention will now be described more fully with reference to a few practical situations.

Fig. 2 shows the building-up phase on a trunk line TRK (connected to source terminal TC), which is

connected through the peripheral module PM_A of the sub-system DS_A, the switching system SN_A and the intersystem line IL_{AB} to the switching network of sub-system DS_B. After the control-unit MCU_B of the sub-system DS_B has assessed that the destination terminal T_B is "free", the T stage forming part of the peripheral module of the sub-system DS_B applies through an input RT a ringing tone to a source T_S. The destination gate itself provides the ringing note to the destination T_D. The response destination terminal T_D is then the T stage of the peripheral module PM_B and switched on (indicated by broken lines in Fig.3) so that at the same time the ringing tone for the two parties is interrupted.

If during ringing the destination terminal T_D has to be changed.over in the case of non-response to the destination terminal T'_D, which is associated with a different sub-system DS_C, a situation as illustrated in Fig. 3 occurs. Through input RT of T stage of peripheral module PM_B the source terminal T_S is uninterruptly rung. The destination unit MCU_B of sub-system DS_B transmit the new location of the destination terminal T'_D to the control-unit MCU_A of the source system DS_A. This control-unit (MCU_A) transfers through the intersystem line IL_{AC} the (signalling) information to the sub-system with which the destination T'_D is associated and then switches further connection. The sub-system DS_C emits ringing current to destination terminal T'_D. When the destination terminal T'_D responds, the reply signal is rapidly transferred to the sub-system DS_A, after which in the switching network of the source system DS_A a change-over takes place to the connection indicated by broken line. In the T stage of the peripheral module PM_C of the destination sub-system DS_C the connection indicated by broken line is fixed. An advantage of this way of ringing is that the rhythm of the ringing tone for the source terminal T_S remains unvaried, since the ringing tone continues emanating from the sub-system DS_B.

Fig. 4 illustrates the outgoing intervention by an operator. The terminal T_S and the source sub-system DS_A

desire an outgoing (trunk) connection. In principle, the three parties concerned i.e. the source, the destination and the desired trunk may be located in three different sub-systems. Such a case is shown in Fig. 4. The control-unit of the sub-system DS_A, with which the terminal T_S is associated, transmits in the manner described above the (signalling) information to the control-unit of the sub-system DS_B, with which the operator OPR is associated and the connection is switched on so that the operator can communicate with terminal T_S through the T stage T_A of the peripheral module PM_A of the source sub-system DS_A, a path through switching system SN_A, the intersystem line IL_{AB}, a path through the switching system SN_B of the sub-system with which the operator is associated, the T stage T_B of said sub-system (SN_B) and the operator. The operator will then establish a connection to an outgoing trunk line TRK through the source sub-system DS_A to the sub-system DS_C with which is associated the destination T_D, in other words there is not established a direct connection from sub-system DS_B to sub-system DS_C. Consequently this connection is formed by a path through the T stage T_B of the peripheral module PM_B, to which the operator is connected, by a path through switching system SN_B, the intersystem line IL_{BA}, a path through the switching system SN_A, the intersystem line IL_{AC}, a path through switching system SN_C and finally through the trunk circuit TRK to the destination T_D. At a response by the destination the dotted connection RUP (reserved ultimate path) is made in the switching system SN_A of the source sub-system DS_A. It is also possible to switch in two steps: at a responce by the destination TUD first a dotted connection RPP (reserved provisional path) can be made in the operator sub-system DS_B and only then the connection RUP in the source sub-system DS_A. An advantage of this manner of building up an outgoing connectinn is that the connections are made so that the final condition is as simple as possible. Moreover, a rapid reaction to the operator handling is thus ensured.

Although the Figure shows the two different intersystem lines between the sub-systems DS_A and DS_B (i.e. IL_{AB} and IL_{BA}) this is not necessary: the connection may be formed either by two channels on one multiplex line or by one channel on such a line designed for two direction traffic. Moreover, as stated above, the intersystem lines include one or more common channel signalling channels and a number, for example, 30 of communication channels.

The Figure (Fig. 4 and also the Fig. 5 to be described hereinafter) does not show the control-unit forming part of each sub-system in order to avoid useless complication of the Figure. Each sub-system comprises such a control-unit connected in the manner described in Figs. 1 to 3.

Fig. 5 shows a situation as in Fig. 4, in which the destination T_D is not "free", but communicates with a third terminal T_E associated with a further sub-system DS_D. The connection is then built up as follows: First as described for Fig. 4 a connection is made between the sub-system DS_A and the operator sub-system DS_B. Then the operator makes a connection both to the destination sub-system DS_C and to the terminal associated with the sub-system communicating with the destination. For this purpose through a path in the T stage T_B of the peripheral module PM_B, to which the operator is connected, the operator makes a connection to "add-on circuit AO". From the add-on circuit AO connections are made to the destination sub-system DS_C and to the third sub-system DS_C (not directly), however, both through the source sub-system DS_A. The connection of the operator to the destination sub-system is passed along T stage T_B, the switching system SN_B, the intersystem line IL_{BA}, the switching system SN_A, intersystem line IL_{AC}, switching system SN_C, T stage T_C to the destination terminal T_D. The connection of the operator to the tird sub-system is passed for a large part through the same route <u>i.e.</u> through T state T_{B1}, switching system SN_{B1}, intersystem line IL_{BA1}, switching system SN_A, intersystem line IL_{AC1},

switching system SN_{C1}, switching system SN_D, T stage T_D, a third terminal T_E. The operator then has the possibility to communicate simultaneously with the two terminals (T_D and T_E) and with terminal T_A separately. When the connection between terminals T_D and T_E is finished (connection P_{DE} falls off) then in switching system SN_A, the source sub-system DS_A thepath RUP (indicated by dots) is connected further so that the connection between source and destination becomes established. It is also possible to attain this connection of source and destination in two phases i.e. by first in the switching system of the opeator sub-system DS_B the path RPP (indicated in dots) is made and only then the path RUP in switching system SN_A.

The advantage of this building manner is that the final condition of routining is as simple as possible.

It is obvious that the telecommunication system is suitable not only for transmitting call signals but also for carrying out also all kinds of data traffic.

CLAIMS

1. A telecommunication system, in particular a telephone system comprising a plurality of intercoupled sub-systems, each sub-system comprising a switching system, a control-unit and at least one peripheral module, to which module communication lines can be connected, characterized in that the control-unit of each sub-system possesses a list of numbers inside the system, that on the basis of a destination number provided by a source which is connected to a peripheral module _via_ a communication line, it is determined to which sub-system the destination is associated, which destination is connected to a peripheral module _via_ a communication line, and that when the destination sub-system differs from the source sub-system the necessary (signalling) information about identity and characteristics of the source, is transmitted the control-unit of the destination system and the connection is made to the destination sub-system and that the control-unit of the destination sub-system analyses said information and, as the case may be, establishes the connection to the destination.

2. A telecommunication system as claimed in Claim 1, characterized in that when the destination is passed around by the destination sub-system, information about the new destination is transmitted to the control-unit of the sub-system with which the new destination is associated through the control-unit of the source sub-system.

3. A telecommunication system as claimed in Claim 1 or 2, characterized in that the sub-systems are coupled with multiplex lines including at least one channel for transmitting information.

4. A telecommunication system as claimed in Claim 3, characterized in that said channel is a 64 kbit/s common

channel signalling channel inside a 2 M bit/s multiplex line.

5. A telecommunication system as claimed in anyone of the preceding Claims, characterized in that in an outgoing intervention an operator connected to a sub-system differing from the source sub-system makes a first connection of the source sub-system to the operator sub-system, a second connection of the operator sub-system through the source sub-system to the destination sub-system and, in the case of response by the destination in the source sub-system, a connection is made between the source to the destination by shortcircuiting the source-operator and the operator-destination connection.

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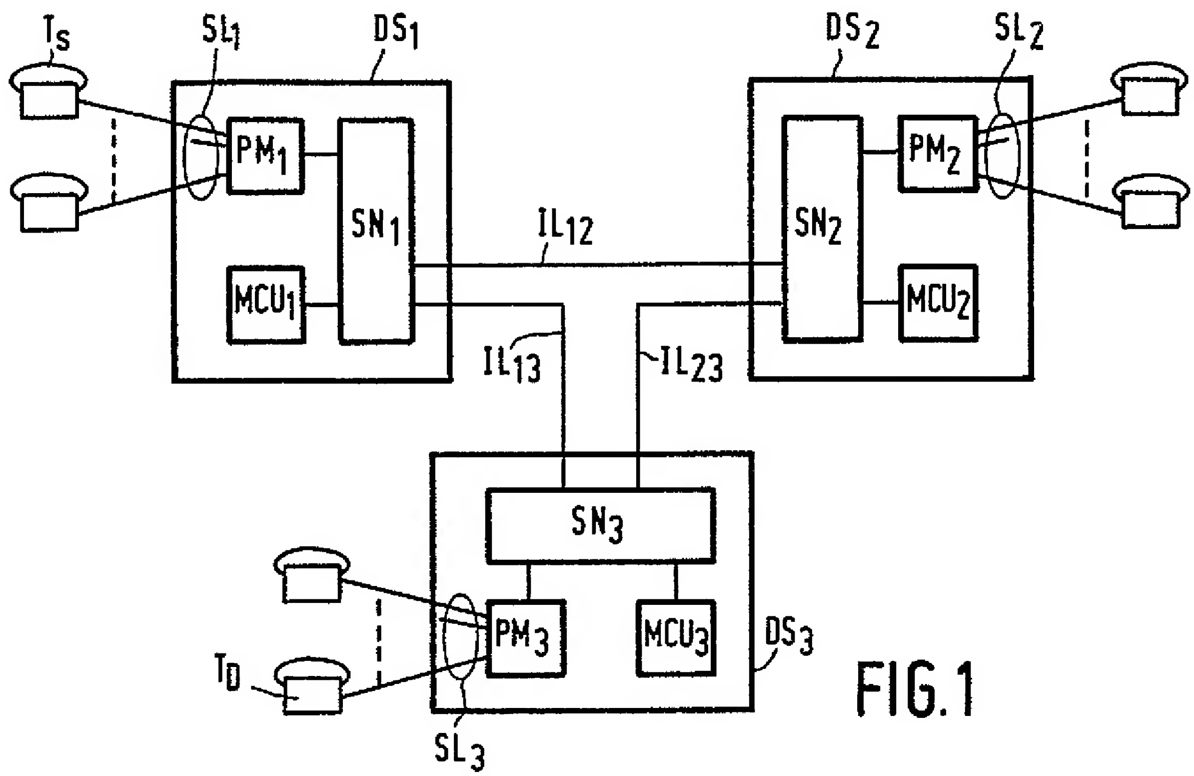


FIG. 1

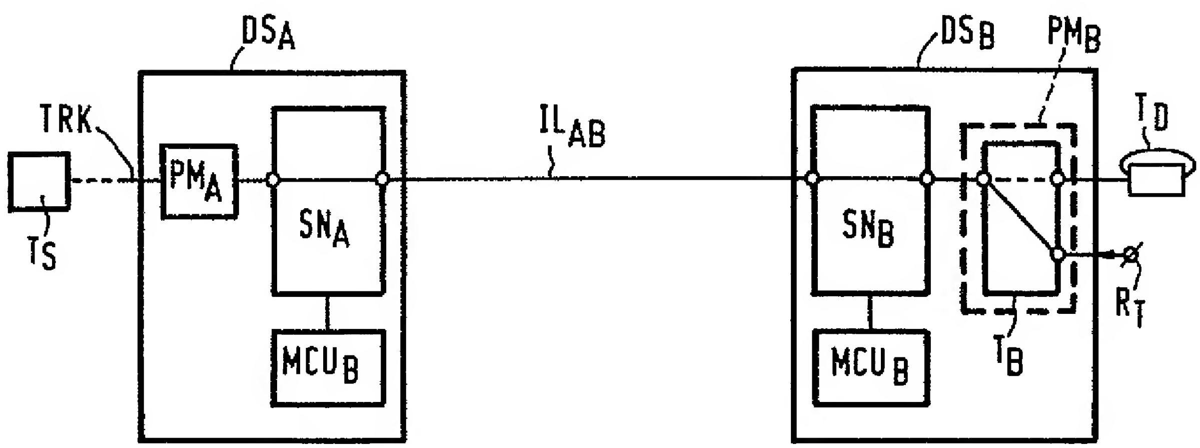
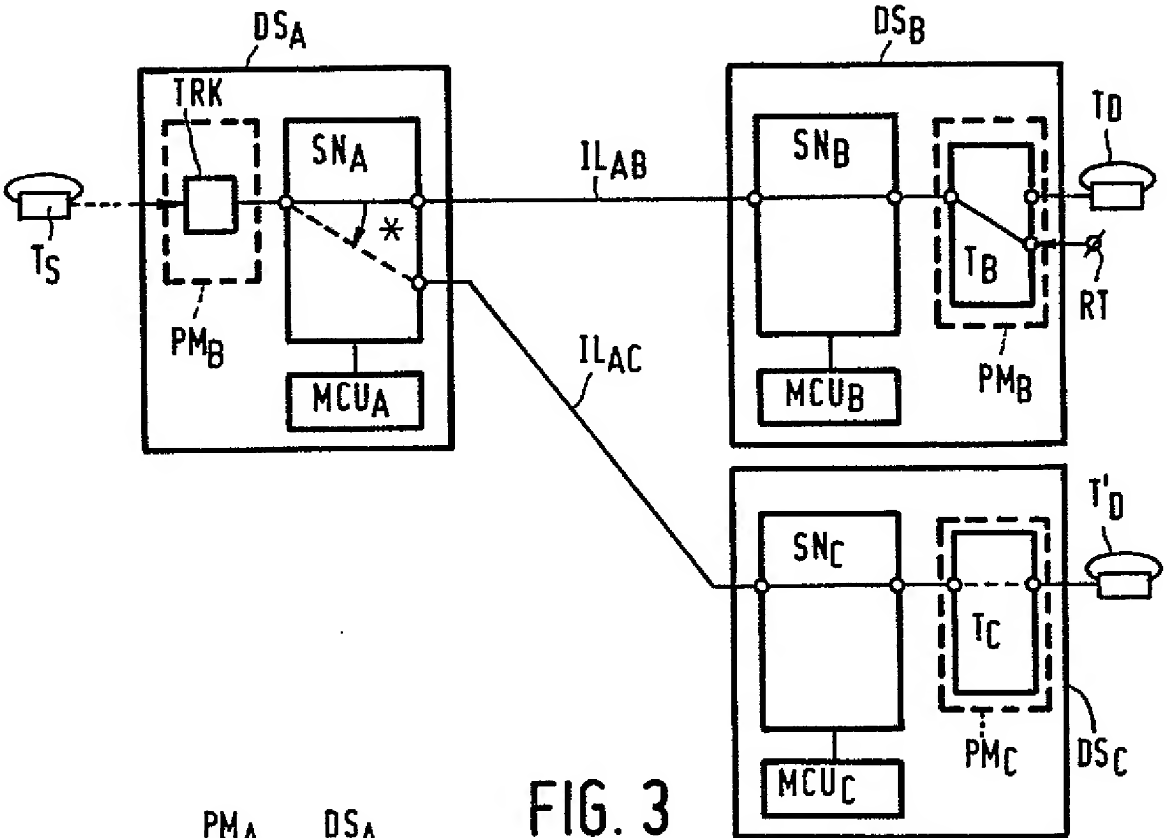
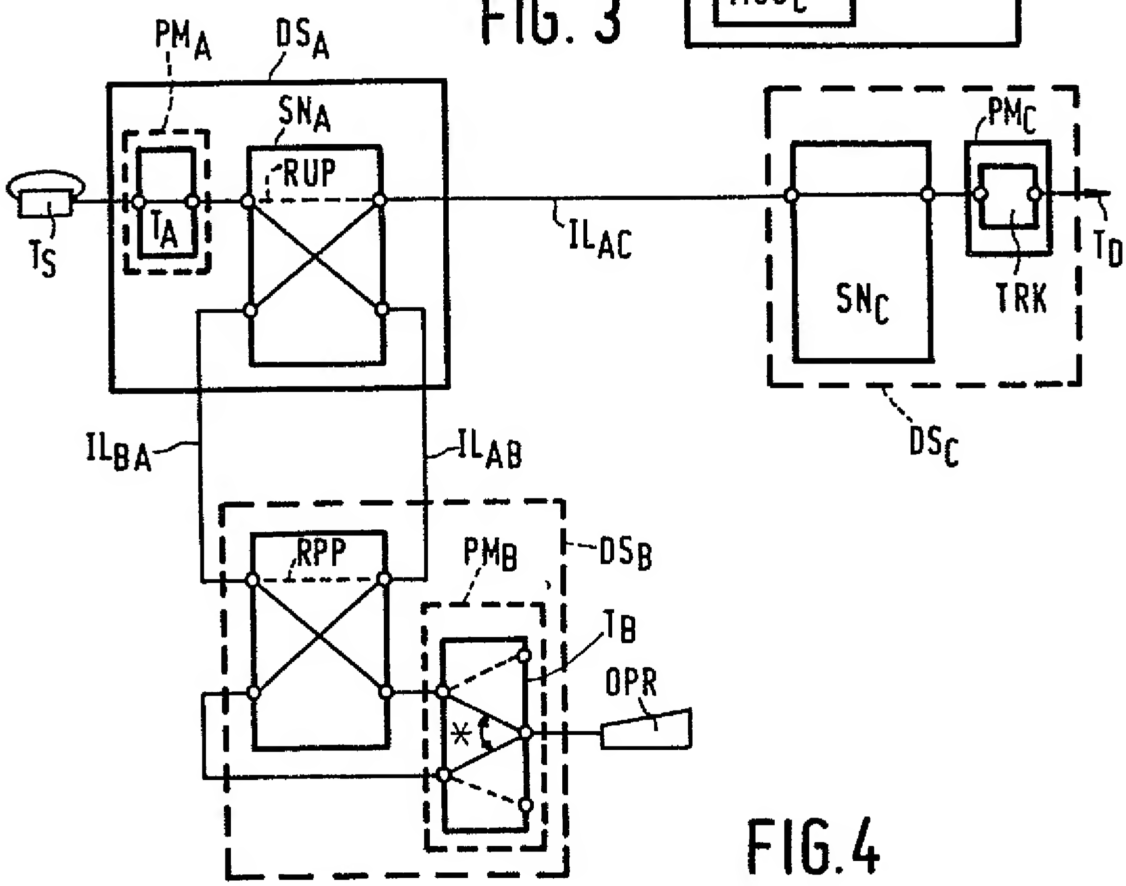


FIG. 2



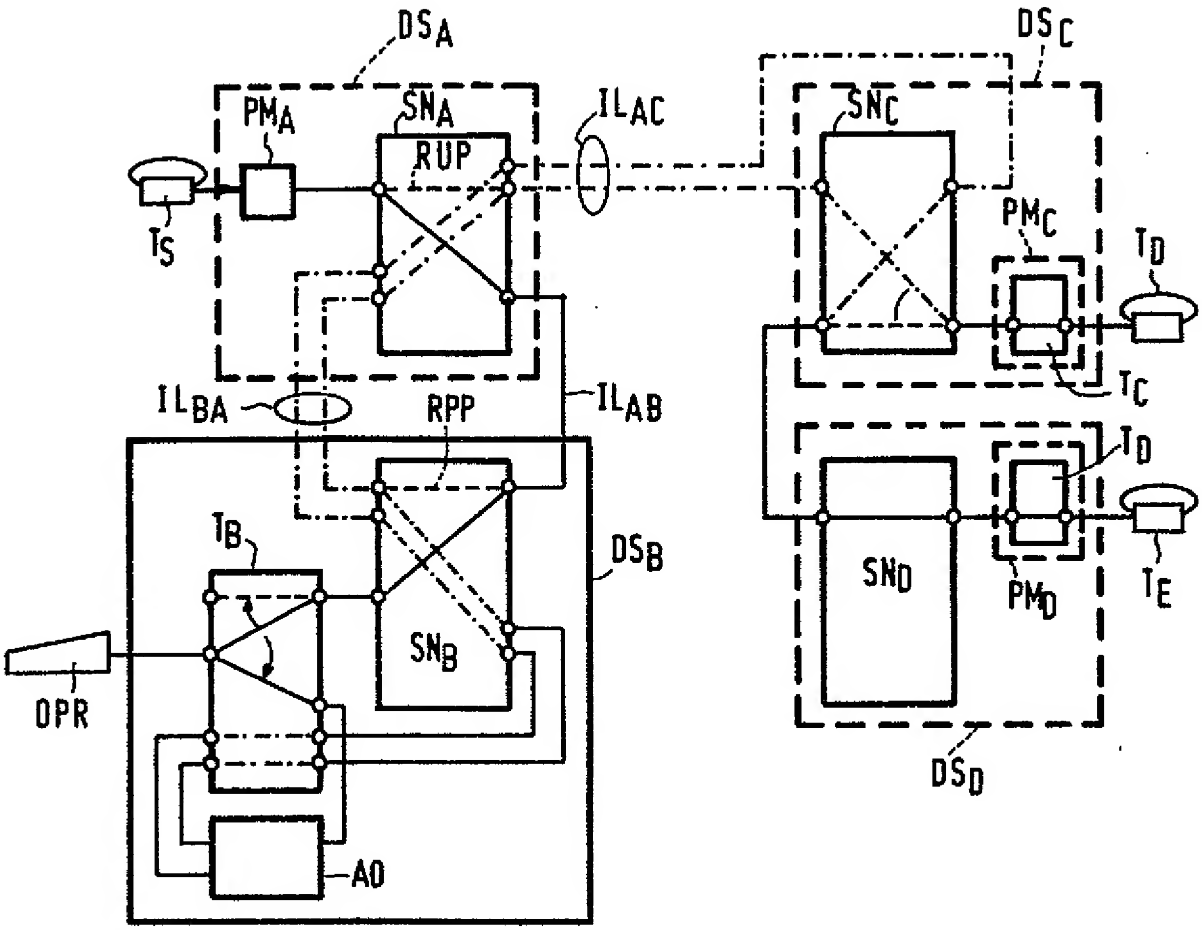
DSA
TRK
SNA
PMB
MCUA
ILAB
ILAC
DSB
SNB
TB
MCUB
PMB
TD
RT
TS
SNC
TC
MCUC
PMC
DSC
T'D

FIG. 3



PMA
DSA
SNA
RUP
TA
TS
ILAC
PMC
SNC
TRK
TD
DSC
ILBA
ILAB
RPP
PMB
DSB
TB
OPR

FIG. 4



DS_A
PM_A
SN_A
RUP
IL_{AC}
DS_C
SN_C
PM_C
T_D
T_S
T_C
IL_{BA}
RPP
IL_{AB}
T_D
T_B
DS_B
SN_D
T_E
PM_D
OPR
SN_B
AO
DS_D

FIG. 5

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EUROPEAN SEARCH REPORT

0161031
Application number

EP 85 20 0645

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	EP-A-0 073 078 (ITALTEL) * Page 1, line 22 - page 2, line 7; page 17, line 16 - page 19, line 9 * ---	1,3	H 04 Q 3/495 H 04 Q 11/04 H 04 M 3/54
A	INTERNATIONAL SWITCHING SYMPOSIUM, 21st-25th September 1981, Montreal, Canada, pages 33C-3-1 to 33C-3-7; S. HATTORI et al.: "EPBX for future integrated office system" * Page 3, right-hand column, line 1 - page 4, right-hand column, line 3 * ---	1,3	
A	FIFTH INTERNATIONAL CONFERENCE ON SOFTWARE ENGINEERING FOR TELECOMMUNICATION SWITCHING SYSTEMS, 4th-8th July 1983, Lund, Sweden, pages 184-189; J. SWERUP: "Software architecture in a digital voice/data PABX with distributed control" * Page 184, right-hand column, lines 4-11; page 185, left-hand column, line 8 - page 186, left-hand column, line 7 * ---	1,3,4	TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 04 Q H 04 M
A	PATENTS ABSTRACTS OF JAPAN, vol. 139, 17th November 1978, page 8573 E 78; & JP - A - 53 105 922 (NIPPON) 14-09-1978 * Abstract * -----	2	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18-07-1985	VANDEVENNE M.J.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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